DEVONIAN THELODONT SCALES (AGNATHA, THELODONTI) FROM QUEENSLAND

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Turiniid thelodont scales from the Emsian-Eifelian Cravens Peak Beds of the Toomba Range, Toko Syncline, western Queensland and the undifferentiated Broken River Group (late Emsian *serotinus* Conodont Zone to Givetian) of the Broken River Province of north Queensland are referred to *Turinia gavinyoungi* sp. nov. and *Jesslepis johnsoni* gen. et sp. nov. respectively. □ *Devonian, Thelodonti, Turiniidae, Queensland.*

Susan Turner, Queensland Museum, P.O. Box 3300, South Brisbane, Queensland 4101, Australia; 12 October 1995.

Early to Middle Devonian limestones from the Broken River Province, near Greenvale, north Queensland have yielded microvertebrate assemblages which include rare thelodont scales (Jell et al., 1983; Turner, 1991b, 1993). *Turinia* sp. cf. *T. australiensis* has been reported from the Martin's Well Limestone of Magpie Creek, Shield Creek Group at Broken River (Turner, 1993), and one possible turiniid scale has been found within the Givetian part of the Broken River Group. Within the Burges Formation (late Emsian-Eifelian) of the Broken River Group a series of thelodont scales have been found at various localities in the Burges and Wando Vale districts. In the Toko Syncline, western Queensland, a limestone member of the Cravens Peak Beds has also yielded abundant thelodont scales from shot point localities (Turner et al., 1981; Young, 1984, 1995). The scales from both locations are sufficiently dissimilar to those already known to warrant assignment to new taxa. They are referred to the Turiniidae which comprises 3 genera; *Turinia*, *Australolepis* and *Boreania* (Turner, 1991a). Turiniid thelodonts are now known from all continents in the Lower Devonian and are most longlasting in Gondwana, becoming extinct only in the early Frasnian.

Broken River samples were collected by J.S. Jell (The University of Queensland UQ Locality numbers, UQL) or during sampling for conodonts by John Talent and Ruth Mawson (Mawson et al., 1988; Mawson & Talent, 1989; Macquarie University, Centre for Elostratigraphy & Palaeobiology samples from SAG section); the type specimens are designated with Queensland Museum numbers (QMF). For recent summaries of Broken River geology see Withnall & Lang (1993) and Sloan et al. (1995). The Toko Syncline limestones were collected by John Draper and samples specifically for fossil fish were obtained by Gavin C. Young (type specimens designated in the Commonwealth Palaeontological collection, CPC, based at the Australian Geological Survey Organisation, Canberra).

SYSTEMATIC PALAEONTOLOGY

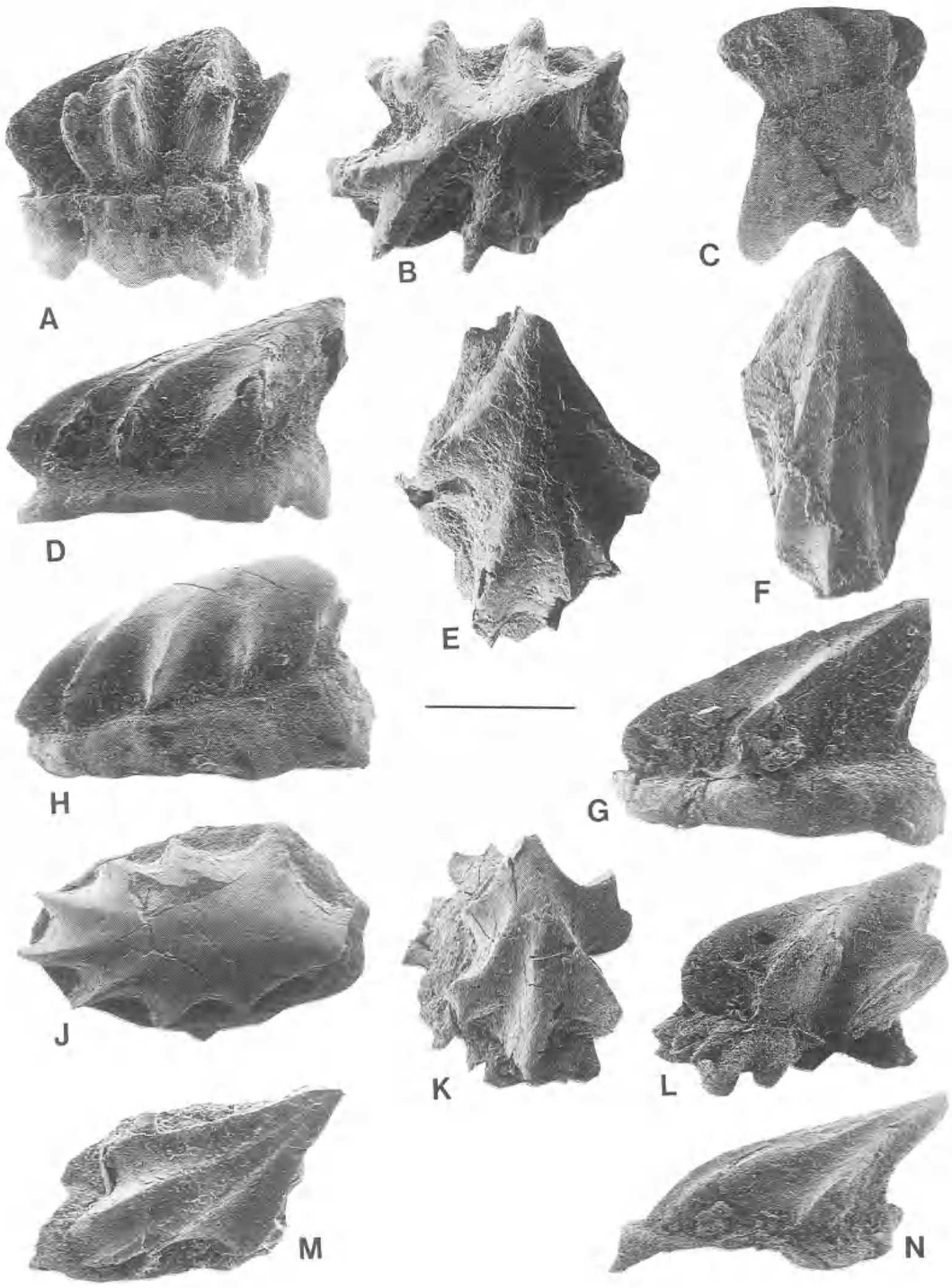
Superclass AGNATHA
Class DIPLORHINA
Subclass THELODONTI
Order THELODONTIDA
Family TURINIIDAE Obruchev, 1964

Jesslepis gen. nov.

TYPE SPECIES
J. johnsoni sp. nov

DIAGNOSIS
Small to medium-sized scales; large open oval to slit-like pulp cavity. Crown rises steadily from anterior to sharp posterior point at an angle of 30-45°. Sharply angled posterior point. Crown narrow, base low, neck virtually absent. Two to four deeply dissected crown ribs meet the crown-base interface at a steep angle. Crown ribs can extend from the anterior rim to the posterior point in a straight line.

REMARKS
Differs from *Turinia*, *Australepis* and *Borania* (eg., Turner, 1991a) in the general morphology of the crown, having a relatively smooth and steeply sloping upper surface in most scale varieties; elongate triangular or arrowhead-like outline; and the low number of crown ribs.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Jesslepis johnsoni sp. nov.
(Figs 1, 2A-M)

1991b turiniid, Turner: 447.
1993 endemic thelodonts, Turner: 183.

DIAGNOSIS
As for genus.

MATERIAL EXAMINED
HOLOTYPE: QMF33724.
PARATYPES: QMF33721-3, 33725-40. 20 scales from UQL4703 youngest; UQL4704 (type locality); UQL4706 oldest; UQL4697; UQL4388; UQL4374; UQL4054, basal Lomandra Limestone, late Emsian and early Eifelian Broken River Group. (stratigraphically below Fish Hill Limestone Member, see Withnall & Lang 1993); SAG 2 (3 scales); SAG 8 (2 scales), SE of Arch Gorge section (Mawson & Talent, 1989; table 5) Chinaman Creek Limestone of Sloan et. al. (1995).

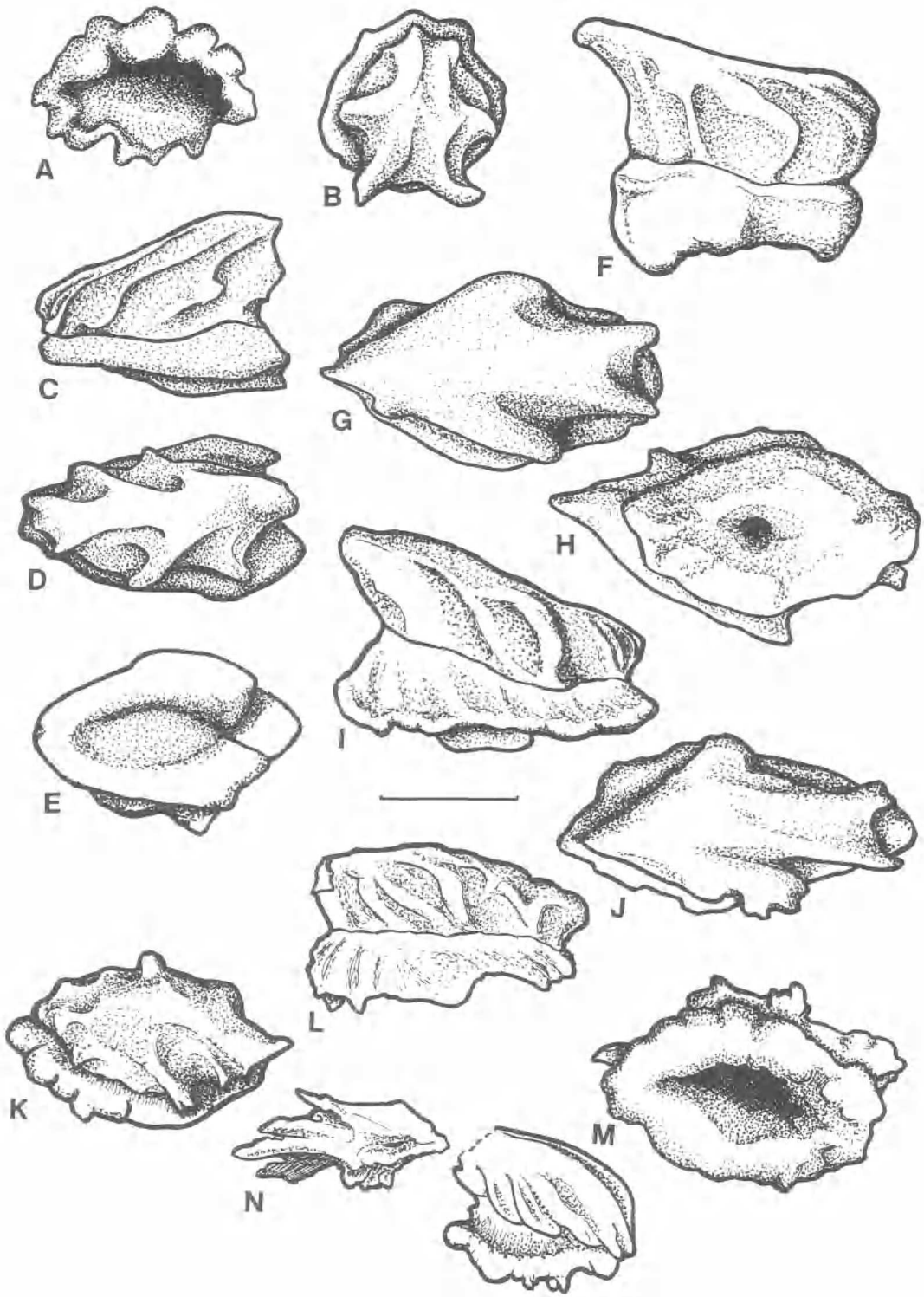
DESCRIPTION
Scales mostly 0.5-1mm long. Oral or head scales (Fig. 2A) are rounded and cap-like in ontogenetically young scales as in most thelodont genera but can have deeply dissected crown ribs which can curve (Figs 1B,C, 2A,B). Cephalopectoral scales are more elongated and can have prongs midway on the lateral ribs (Fig. 1A,L). Lateral ribs can be curved (Fig. 1A, B,D, H) or straight (Fig. 1F-G,M). Postpectoral or trunk scales are narrow and arrow-shaped and generally longer than wide (Figs 1F, 2G,J). V-shaped scales (Fig. 1M) might possibly be from the pinnal or caudal regions. Bases are mostly as large as the scale and about one-third the height (Figs 1D,G-H, 2F,I,L) but can be shallow in ontogenetically young scales (Fig. 1L). Basal crenulations and lobules are common (Figs 1A,E,K-L, 2K,M) often mirroring the shape of the crown. In lateral view the posterior base seems deeper and forms a skirt-like extension (Figs 1D,G, 2C,I,L). The basal cavity can be a shallow central concavity (Fig. 2E) becoming reduced as the base grows to a small central pulp opening (Fig. 2H).

Histology. Internal examination by thin section or by anise oil immersion has not been possible because the blackened specimens are few in number. However, nearly all scales examined are cap-like with a large wide-open pulp cavity but older scales with mature bases are seen (see above and Fig. 2).

AGE
The Burges Formation of Withnall & Lang (1993) has been referred to "undifferentiated Broken River Group" by Sloan et al. (1995). Upper and lower limits of the taxon are not well constrained but on the evidence of associated corals (Jell, pers. comm.) and conodonts from SAG section the possible range seems to be between *serotinus* and basal *ensensis* Conodont Zones.

Thelodont scales are rare in these marine limestones and for now, because of the potential range of variation within turiniid squamations, all but one of the scales found are placed in *J. johnsoni*. De Pomeroy (1994) recorded new shark genera from the Broken River sequence, mainly from the late Eifelian-Givetian interval (*kockelianus-varcus* Zones), associated with acanthodian, thelodont, placoderm, and osteichthyan remains. She has reported one thelodont scale from the Eifelian SAG section (De Pomeroy, pers. comm.) which has been referred to an indeterminate thelodont (De Pomeroy, 1995, in press, fig. 6M, N). This scale is referred to the new genus and most closely resembles the scale illustrated in Fig. 3B. The new scales described here come from a series of limestone samples, notably from the measured section "SAG" which has conodont control (Mawson et al., 1988; Mawson & Talent, 1989). There are now three scales from SAG 2, and two from SAG8. These scales occur 26.8 and 67m above the base of the sections respectively (Mawson & Talent, pers. comm.) SAG2 conodonts include *P. l. linguiformis* and *P. parawebbi*, which co-occur in the *australis* Zone (Mawson & Talent, 1989; fig. 9). Conodont elements, *I. struvei* and *P. l. klapperi* appear at 55.6m above the base of SAG section (Mawson & Talent 1989, Table 5). SAG8 would, therefore, appear to be close to the base of *ensensis* Zone. The new scales are associated with onychodont teeth and undetermined acanthodian scales, *Cheiracanthoides* cf. *comptus* (*C. comptus* s.s. is typical of latest Emsian-Eifelian; Turner, 1993), cosmine scales, shark scales (De Pomeroy, 1994) and possible shark teeth.

FIG. 1. *Jesslepis johnsoni* gen. et sp. nov. from UQL4704, Broken River Group, Broken River Province, Queensland, Australia. A, QMF33721, lateral view. B, crown view of A. C, QMF33722, lateral view. D, QMF33723, lateral view. E, crown view of D. F, Holotype QMF33724, crown view. G, lateral view of F. H, QMF33725, lateral view. J, crown view of H. K, QMF33726, crown view. L, antero-lateral view of K. M, QMF33727, crown view. N, lateral view of M. Bar = 0.5mm.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REMARKS

In common with other Australian turiniid scales (e.g. *Turinia australiensis*, *Australolepis seddoni*; Turner, 1991b), the new taxon shares some general characters such as the high crown, large ulp cavity and cap-like nature of most scales. However, micro-ornament is absent; this latter character appears in many of the Gondwanan species of *Turinia* and appears to have phylogenetic sinificance (Turner, submitted).

ETYMOLOGY

In honour of Dr J.G. ("Jess") Johnson (1932-1994), Devonian biostratigrapher and palaeontologist, and *lepis*; Greek; scale.

Turinia gavinyoungi sp. nov.
(Figs 2N?, 3)

1981 *Turinia* cf. *pagei*, Turner et al.: 54, figs. 6-8, 10J-L, 11H.
1991b *Turinia* n. sp., Turner: 447, pl. 5D, fig. 4B, E-G.

DIAGNOSIS

Head and trunk scales large with high crowns. In trunk scales anterior median crown section narrow. Crown deeply dissected with ribs and lobes leading to a high central ridge culminating in sharp posterior point. Typically three pairs of lateral ribs. Ribs can be split and upturned. Multiplication of riblets and lappets on crown. Micro-ornament sometimes present. Concave neck. Base usually wider than crown and expanded anteriorly. Basal nodules common.

MATERIAL EXAMINED

HOLOTYPE: CPC 20079/3 in Turner et al., 1981, fig. 7E, a typical trunk scale from a small limestone outcrop in the southern part of Toomba Range, western flank of Toko Syncline, Georgina Basin, western Queensland, central Australia. Approximate latitude and longitude 23° 23' 47"S, 138° 08' 10"E (map and section in Turner et al., 1981, fig. 2; Turner & Young, 1987, fig. 1). Cravens Peak Beds: upper Emsian? - lower Eifelian, top Lower? - basal Middle Devonian (see discusssion in Young 1995).

PARATYPES: CPC20079/1-2, 4-20, 20080/1-4 from sample GEO 65/28 (Turner et al. 1981); GB77.(loc. 11) G.C. Young coll. V1649, QM F33742-97 from same locality as the type specimens. QMF33741 from UQL4374 Burges Formation of Broken River Province might belong to this taxon.

DESCRIPTION

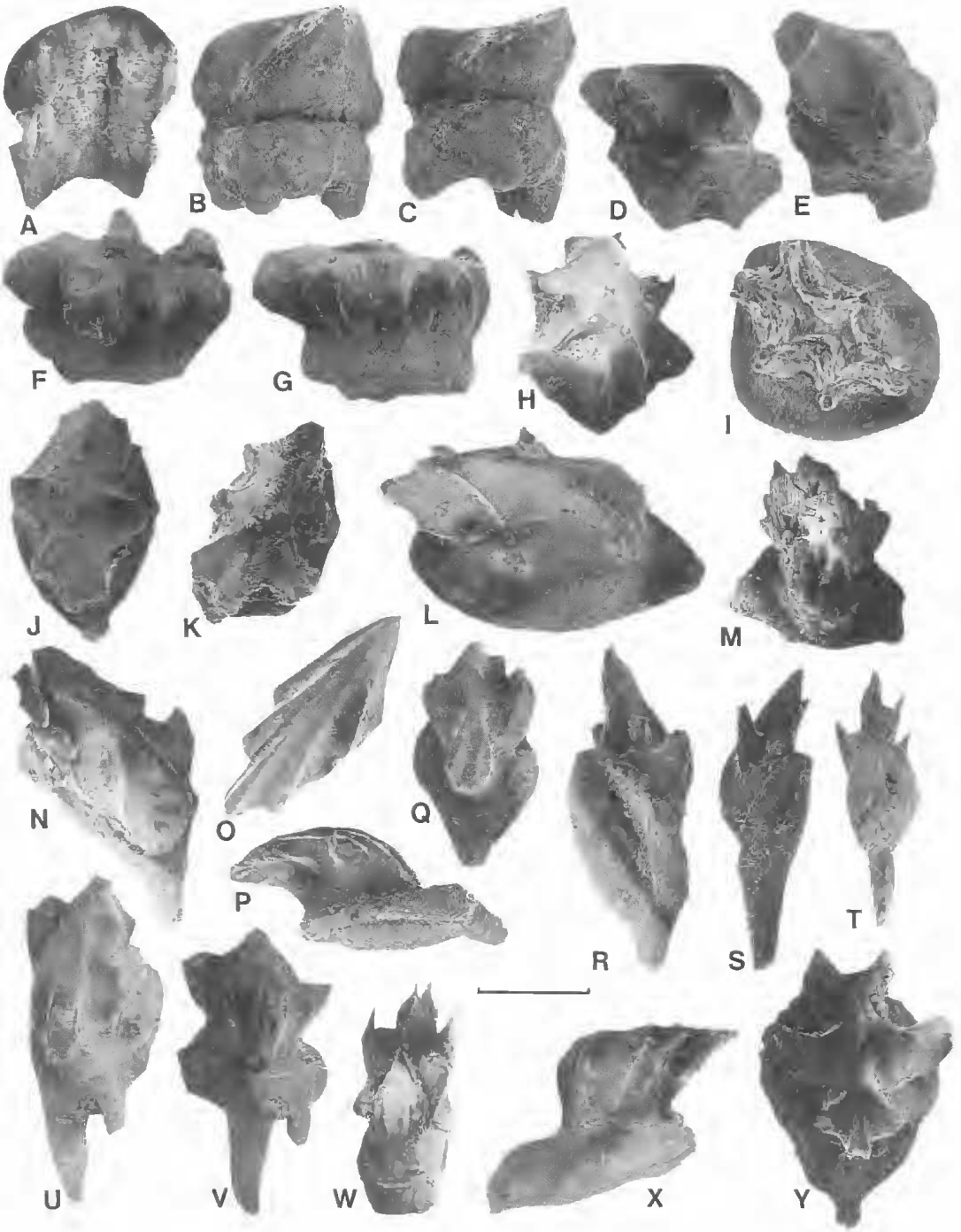
See descriptions and measurements given in Turner et al. (1981: 55); average length 1.5mm. Material from sample GB77 is figured here for the first time. Head/oral (Fig. 3A-C), cephalopectoral/transitional (Fig. 3D-L,Y?) and trunk scales (Fig. 3M-X) are found. Turner et al. (1981; figs 6-8) showed some of the range of scale variation. Crowns are typified by the outwardly expanding triangular lappets which end in many posterior points (Fig. 3M-N, R-W) The crown can be divided into five or more compartments by, typically, three pairs of deeply dissected ribs and lappets (Fig. 3J-L,Y). The posterior median part of the crown is sharply pointed and can be recessed below the crown ridge (Fig. 3R,W). Lateral ribs can expand into an upward turning projection at mid length or near the crown-neck interface (Fig. 3L,N,P). Multiple ribbing (Fig. 3M) and micro-ornament is seen especially on trunk scales (Turner et al., 1981; figs 7E-G, 8D, 10J). On the bases very long anterior processes are typical (Turner et al., 1981; fig. 8B; Fig. 3R-T) and commonly can be double but with one process longer than the other (Fig. 3U-V); this latter might represent an individual variation. Multiple basal lobules (Fig. 3B) can occur (Turner et al., 1981; fig. 8A).

Histology. Preparation in anise oil shows a typical turiniid dentine crown with thin durodentine cap surmounting a large base of aspidine penetrated by the canals of Sharpey's fibres (Turner, 1991a). Large pulp cavities are common (Fig. 3A). Although the dentine tubules seem relatively sparse, they are straight with few branches except at the proximal ends; no clearly specific attributes can be seen except where the dentine tubules are longer to reach into the expanded lappets and rib extensions.

REMARKS

Turner (in Turner et al., 1981) compared this form with the type species, *Turinia pagei* Powrie in its well-developed elongate high crown with a slight anterior notch. The scales differ in the more

FIG. 2. Broken River Group thelodont scales. A-M, *Jesslepis johnsoni*. A, QMF33728 head scale from UQL4054, basal view. B, QMF33729 from UQL4704, crown view. C-E, QMF33730 from UQL4704. C, lateral view. D, crown view. E, basal view. F-H, QMF33731 from UQL4704. F, lateral view. G, crown view. H, basal view. I-J, QMF33732 from UQL4388. I, lateral view. J, crown view. K-M, QMF33733 from UQL4388. K, crown view. L, lateral view. M, basal view. N, *Turinia gavinyoungi*?, QMF33741, broken scale from UQL4374. Bar = 0.5mm.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extreme development of lappets and partitions of the crown, seen particularly well in the trunk scales. Closely spaced double ribs are comparable with those of Givetian *Turinia hutkensis* Blieck & Goujet (1978) of Iran, whereas the out-turned ribs resemble those of the Eifelian to Givetian *T. pagoda* and *T.* spp. A & B of West Yunnan, China (Wang et al., 1986). The presence of micro-ornament suggests close relationships with the earlier *T. australiensis* group of scales, as well as to Givetian taxa, *T. pagoda* and *T. antarctica* Turner & Young (1992). The scales in the Cravens Peak Beds sample are robust and although the crowns can be well scalloped they do not exhibit the fragility and lightness seen in scales of the early Frasnian turiniid, *Australolepis*. One possible scale from the marine limestones of the Broken River Group with posterior extensions and lappets (Fig. 2N) might be a scale of *Turinia gavinyoungi*.

Thelodont scales outnumber acanthodian scales in the assemblage by approximately 4:1. The associated fauna includes climatiid spines, *Acanthodes* type and *Machaeracanthus* scales; scales and bones of an antiarch placoderm (Young, 1984); shark teeth *Mcmurdodus*, (Turner & Young, 1987) and various shark scales. Onychodont teeth are common as well as scales of a sarcopterygian. Lepidotrichia are also present. The samples appear to be relatively unaltered, the colour ranging from orange to rose quartz and, given the good preservation and lack of abrasion, the scales are unlikely to have been transported far.

ETYMOLOGY

For Dr Gavin C. Young, Devonian fossil fish worker, who collected much of the Cravens Peak material.

AGE

Based on the associated vertebrate assemblage, the present consensus favours an Eifelian age for the in situ limestones of the Cravens Peak Beds (Young, 1995). In the absence of conodonts the evidence is provided by fish and crustaceans. P.J. Jones (in Turner et al., 1981) noted that the ostracods and the eridostracan from shot point samples and from GEO 65/28 were most like those of early Devonian age from the northern hemisphere. The thelodont in the shot point samples is *T.* cf. *australiensis* and thus could be as old as mid Lochkovian-Pragian or more likely early Emsian (Turner, submitted). *T. gavinyoungi* occurs in samples GEO 65/28 and GB77. Comparing this taxon with others known from Australia, from the nearby Ross River (Young et al., 1987) and Hatchery Creek Formation (Young & Gorter, 1981) where there are scales comparable with *Turinia* sp. of Khush-Yeilagh and *T. hutkensis* of Iran (now thought to be of early Eifelian and late Givetian age respectively (Lelièvre et al., 1993), then an Eifelian age for *T. gavinyoungi* seems most probable.

SIGNIFICANCE

Work in the last decade has clarified the range and distribution of thelodont scales in Australian Devonian sequences (Turner, 1995; Young, 1995). Their usefulness as zonal or age indicators has been acknowledged especially in the absence of conodonts. The taxonomy of Australian thelodonts is better understood now that comparisons can be made from a series of different facies from many horizons throughout the Lower to early Upper Devonian and from several countries. With the aid of recent studies of condont-dated sequences, the ranges of thelodont species have been refined (Turner, 1995; submitted; Young, 1995).

The new scales from north Queensland are unlike any previously decribed in the Devonian. In their simplicity they resemble earlier Silurian thelodont scales but the ubiquitous light-weight of the base with a large pulp cavity is a feature in common with the younger *Australolepis* of the early Frasnian of Western Australia. Further studies from conodont-dated sections should help to refine the range of *Jesslepis*.

FIG. 3. *Turinia gavinyoungi* sp. nov. from the Cravens Peak Beds of the Georgina Basin, Queensland, Australia. A-C, I? Head/oral scales. D-H, J-L, Y? cephalopectoral/transitional scales. M-X, trunk scales. A, QMF33742, internal sagittal section of broken scale. B, QMF33743, lateral view. C, QMF33744, lateral view. D, QMF33745, lateral view. E, antero-lateral view of D. F, QMF33746, crown view. G, lateral view of F. H, QMF33747, crown view. I, QMF33748, crown view of oral or special scale. J, QMF33749, crown view. K, QMF33750, crown view. L, QMF33751, lateral view. M, QMF33752, crown view. N, QMF33753, crown view. O, QMF33754, crown view. P, QMF33755, lateral view. Q, crown view of P. R, QMF33756, basal view. S, QMF33757, latero-basal view. T, basal view of S. U, QMF33758, lateral view. V, anterior view of U. W, QMF33759, anterior view. X, lateral view of W. Y, QMF33760, crown view. Bar = 0.5mm.

T. gavinyoungi is comparable with Early Devonian scales such as *Turinia pagei*, and *T. australiensis* but is more like Middle Devonian turiniids from elsewhere in Gondwana. As the Cravens Peak Beds contains no conodonts, assessment of the associated fauna has suggested the age of *T. gavinyoungi* as Eifelian (Young, 1995). However, the possibility that one scale from the conodont-bearing Broken River Group belongs to this taxon suggests that the age and range will be clarified by future sampling of measured sections.

ACKNOWLEDGEMENTS

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APPENDIX

Broken River province (approximate latitude and longitude 19°144°40'E) sample locality details;

UQL4703 (youngest), UQL4704, UQL4706 (oldest), south-folded limestones, traverse to road from Digger's Creek Crossing (BURGES 1:100,000 Sheet 7859; 683.489) stratigraphically below Fish Hill Limestone Member (see Withnall & Lang 1993).

UQL4697 limestone about 70m W of old road crossing at Digger's Creek, stratigraphically below Fish Hill Limestone Member, see above.

UQL4734 thin limestone in shale, north bank of Broken River upstream of Gorge (645.457);

UQL 4388 thin crinoidal debris limestone, north bank of Broken River upstream from UQL4374 (644.458);

UQL4054 western creek bank of Dosey Creek, 750m upstream from its junction with the Broken River (615.438), basal Lomandra Limestone, late Emsian;

MUCEP samples SAG 2; SAG 8: SAG = a measured section through Chinaman Creek Limestone Member (Mawson & Talent, 1989, fig. 1, 4, table 5) commencing SE of Arch Gorge (at BURGES Sheet, 717.539) approximately 4.2km E of Jessey Springs Hut.